

## **Development and Support for the US GODAE Server**

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### **LONG-TERM GOALS**

The USGODAE Monterey Data Server is envisioned as the hub for US (and international) GODAE projects. To meet this goal, the data server must fulfill three major roles. First, the server must act as a data server, providing reliable access to observational data and surface forcing fields to drive GODAE ocean models. Second, the server must be part of a framework to access and compare ocean model, or demonstration product output; so, researchers can validate and analyze their data. Finally, the server must have well-organized, easily accessible documentation to simplify data usage, and provide details for the many GODAE and US GODAE projects.

The USGODAE server should eventually become the first stop for users seeking US GODAE data, documentation, or model output. Through USGODAE, Users will be able to locate data and documentation hosted both on and off the server. The Asia Pacific Data Research Center (ADPRC), which is hosted by the International Pacific Research Center (IPRC) at the University of Hawaii, will function as a companion data center in support of GODAE climate forecast. Over time the two servers will be configured to appear as a single virtual data service for GODAE users.

### **OBJECTIVES**

GODAE provides the context for bringing existing ocean data assimilation developments and applications together to accelerate improvements and their transition to the operational environment. Ready access to quality-controlled observations is a necessity to achieve this. The GODAE server in Monterey is envisioned to satisfy this requirement, and at the same time to promote interactions between observationalists and data assimilators and between different assimilation groups. These interactions are needed to share and extend the knowledge base that will lead to a successful experiment.

The USGODAE Monterey server should be a prototype for data assembly centers (servers) in the Integrated Ocean Observing System (IOOS). To this end, the data server project must be closely involved with the projects developing, implementing, and promoting community data serving standards. This approach not only benefits the data server, by making data available through standard protocols and formats, but also helps promote the standards by serving data sets of interest to GODAE

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participants, and the broader oceanographic community. Furthermore, it aids the development of data serving software; since the standard servers must be adapted to the wide range of formats hosted on USGODAE, and made to work with the USGODAE near real-time data streams.

## **APPROACH**

The Monterey data server provides a stable, high reliability, high availability platform for data hosting. Since the servers are housed in the FNMOC operational data center, with 24x7 monitoring and support, users are guaranteed fast, dependable access to data and documentation. The server hosts a wide range of observational data, surface forcing fields, and model output, of interest to GODAE participants and the broader oceanographic community. Data discovery is simplified by an easy to use Web application that allows key-word searches, or direct selection from a data catalog. The discovery application provides users with complete access, usage, and documentation information for each data set.

One of the main challenges of hosting numerous data collections in several different formats is supplying users with the tools and documentation to retrieve and use the data effectively. The first step to solve this problem is providing complete documentation, and links to any available support programs through the data discovery application. Also, the server uses a number of Web applications, including Live Access Server (LAS), to generate quick on-line preview images of almost all of the data hosted on USGODAE. Finally, the server follows community data serving standards, like those specified in the National Virtual Ocean Data System (NVODS); consequently, users have a wide range of well-documented interfaces, APIs, and applications to access and use USGODAE data.

### **Key Individuals:**

*Program/Data Manager, Phil Sharfstein:* Provides oversight of the server, including assurance of correct and reliable operation of the server and its associated Web Site, documentation, evaluation of server functionality and utility, and coordination of work by supporting personnel at FNMOC and PMEL. Interacts with GODAE users to publicize and promote use of this data and respond to all requests for information from users. Performs outreach and interaction with the GODAE science community to identify and install new data sets on the server. Liaises with other data serving sites to ensure seamless presentation and minimize duplication. Promotes the server to the GODAE and general oceanographic communities.

*Systems Software/Hardware Support, FNMOC Staff:* Ensure 24x7 operations of the server, including proper operation of fail over and backup contingencies and data archival/retrieval functions and system security.

*Argo GDAC Manager, Mark Ignaszewski:* Installs and maintains the GDAC software on the Monterey server. Monitors GDAC operations on the Monterey server and ensures GDAC data integrity are maintained on the server.

*GODAE Web Site Support, FNMOC Staff:* Maintains and supports the GODAE Server Web site.

*Visualization and Data Distribution Software Development and Support, Steve Hankin and staff members of the Thermal Modeling and Analysis Project (TMAP) at PMEL:* Provides software to

enable uniform, interoperable browsing and comparison of complex curvilinear model outputs and data. Develops and tests initial prototypes of model inter-comparison framework to connect collaborating GODAE modelers. Provides liaison and coordination with the US Integrated Ocean Observing System as chair of the Data Management and Communications (DMAC) Steering Committee of IOOS. Provides liaison and coordination with the National Virtual Ocean Data System as a member of the NVO DS Executive Committee. Provides liaison and coordination with the APDRC GODAE climate data server in Hawaii.

## **WORK COMPLETED**

The Argo GDAC is active, with data from six DACs, representing six countries (AOML, BODC, CORIOLIS, CSIRO, JMA, MEDS). There are a total of 47,670 profiles from 1,273 floats. Argo data are accessible on the server through FTP, HTTP, OPeNDAP, LAS, and a custom data browser/preview generator.

NOGAPS surface forcing fields from FNMOC are now on the server. The ½ degree Gaussian grids are available on the server via HTTP, FTP, OPeNDAP, and LAS. These are the surface components of the NOGAPS restart files. The USGODAE server is the only source for these data outside of FNMOC.

A new database for *in-situ* data provides detailed metadata, an enhanced access over long time periods. The database is accessible through LAS for uniform browsing and subsetting.

The new USGODAE Web Site presents a consistent interface, with easy to navigate menus. New Web applications include a data discovery tool to replace the static data list pages, and a thumbnail image generator for all non-gridded data on the server.

System hardware has been upgraded by adding 1GB of memory to each server. Network infrastructure has been upgraded to Cisco Catalyst switches. All servers now have Unicenter monitoring, to provide instant notification of hardware or software problems.

A section was added to the Web site for US GODAE documents and meeting notes. This positions the data server as the main source for complete US GODAE data and information.

Live Access Server version 6 has been developed and installed, including support for complex hierarchies of data, metadata search, *in-situ* database browsing and limited “sister server” capabilities which will lead to seamless integration of the offerings from the US GODAE server and the APDRC. LAS v 6 includes a “batch” interface, enabling operational models to request formatted data subsets for purposes of initialization or data assimilation without human involvement.

An LAS-based model intercomparison site has been assembled that permits browsing and intercomparison of models from HYCOM, JPL/ECHO, U. Md./SODA, NSIPP and GFDL as well as reference data sets accessible through NVO DS. Model outputs from NAVO are currently being configured into the server.

The US GODAE Server effort (including LAS and OPeNDAP) has provided leadership and coordination for the initiation of the international GODAE model intercomparison framework

(MERSEA) that is being managed by CLS in France, including model outputs from US (HYCOM), France (MERCATOR), UK (FOAM), Italy (MFS), and Norway (TOPAZ).

## **IMPACT/APPLICATIONS**

The USGODAE server provides the framework for many projects essential to the success of GODAE, and the US efforts in GODAE. The server and LAS are positioned to be the focus point for several projects, including the US GODAE model intercomparison, GODAE Ocean QC intercomparison and MERSEA. As the central node in these projects, the data server project is in a unique position to develop methods for researchers to interact, and compare oceanographic data over the Internet.

As a prototypical IOOS data assembly center (data server), USGODAE will help shape the future of major data serving initiatives like NVODS and NOMADS.

## **RELATED PROJECTS**

**National Virtual Ocean Data System (NVODS):** The data servers are part of NVODS and follow the community data serving standards specified by NVODS. Also, the USGODAE data server project contributes to the development and specification of NVODS standards. LAS provides uniform georeferenced visualization, subsetting and comparison for NVODS.

*NOAA Operational Model Archive and Distribution System (NOMADS):* The Monterey server serves as a prototype for public data servers in NOMADS. LAS is the principal visualization engine for NOMADS.

*Thematic Real Time Environmental Data Distribution System (THREDDS):* The data server project is active in the development of THREDDS data catalogs, and uses THREDDS catalogs as one method of data discovery on the servers.

*Cooperative Opportunity for NCEP Data Using IDD Technology (CONDUIT):* The USGODAE Server distributes data through UNIDATA's IDD system. The project is also involved with the planning and development of the CONDUIT system and software.

*International Pacific Research Center (IPRC) GODAE Climate Server:* Creating a blended real-time/climate GODAE site using LAS and OPeNDAP technology.

*Argo:* USGODAE is one of two Global Data Assembly Centers (GDAC), hosting the complete set of quality controlled Argo data.

*Tagging Of Pacific Pelagics (TOPP):* The project acts in an advisory role for TOPP, assisting by specifying data formats, quality control, and serving needs of the data assimilation community.

*NRL/HYCOM/ECCO/NSIPP (US GODAE R&D Systems):* The server provides data to force ocean models. Eventually, model output will be available through the US GODAE Model Intercomparison Project.

*GODAE High Resolution Sea Surface Temperature (GHRSSST)*: The server provides data to GHRSSST to create ocean products. Eventually, the USGODAE server will host GHRSSST products, and may host a GHRSSST data assembly center.

*GODAE QC Project*: The USGODAE server will host the QC project, providing data sets, comparison results, and documentation.

*GODAE Surface Forcing Intercomparison Project*: USGODAE provides surface forcing fields from FNMOC for the Surface Forcing Intercomparison Project.

## **PUBLICATIONS/OUTREACH**

"USGODAE Monterey Data Server", Presentation, NOMADS Fall 2002 Meeting.

"NVO DS and the USGODAE Monterey Data Server", Presentation, OPeNDAP Technical Meeting.

"Status of the US GDAC", Presentation, 2002 Argo Data Management Meeting.

"Argo Data on the USGODAE Web Site", Presentation, 2002 Argo Data Management Meeting.

"THREDDS and the USGODAE Monterey Data Server", Presentation, THREDDS Technical Workshop.

"Fleet Numerical Meteorology and Oceanography Center Products U.S. GODAE", Presentation, IASI-IAS-RODAE and IOCARIBE-GOOS Coastal Modeling Workshop.

"Serving Data the NVO DS Way", Presentation, 2003 Monterey Bay Area Workshop on Data Management and Visualization.

"The USGODAE Monterey Data Server", Presentation, 2003 Monterey Bay Area Workshop on Data Management and Visualization.

"Status of the USGODAE Monterey Data Server", Presentation, 2003 USGODAE Steering Team Meeting.

"USGODAE Monterey Data Server", AMS 83rd Annual Meeting, presentation and published abstract.

"Fleet Numerical Meteorology and Oceanography Center Support for GODAE", EGS-AGU-EUG 2003 Joint Assembly, presentation and published abstract.